Dams for Water Storage

by

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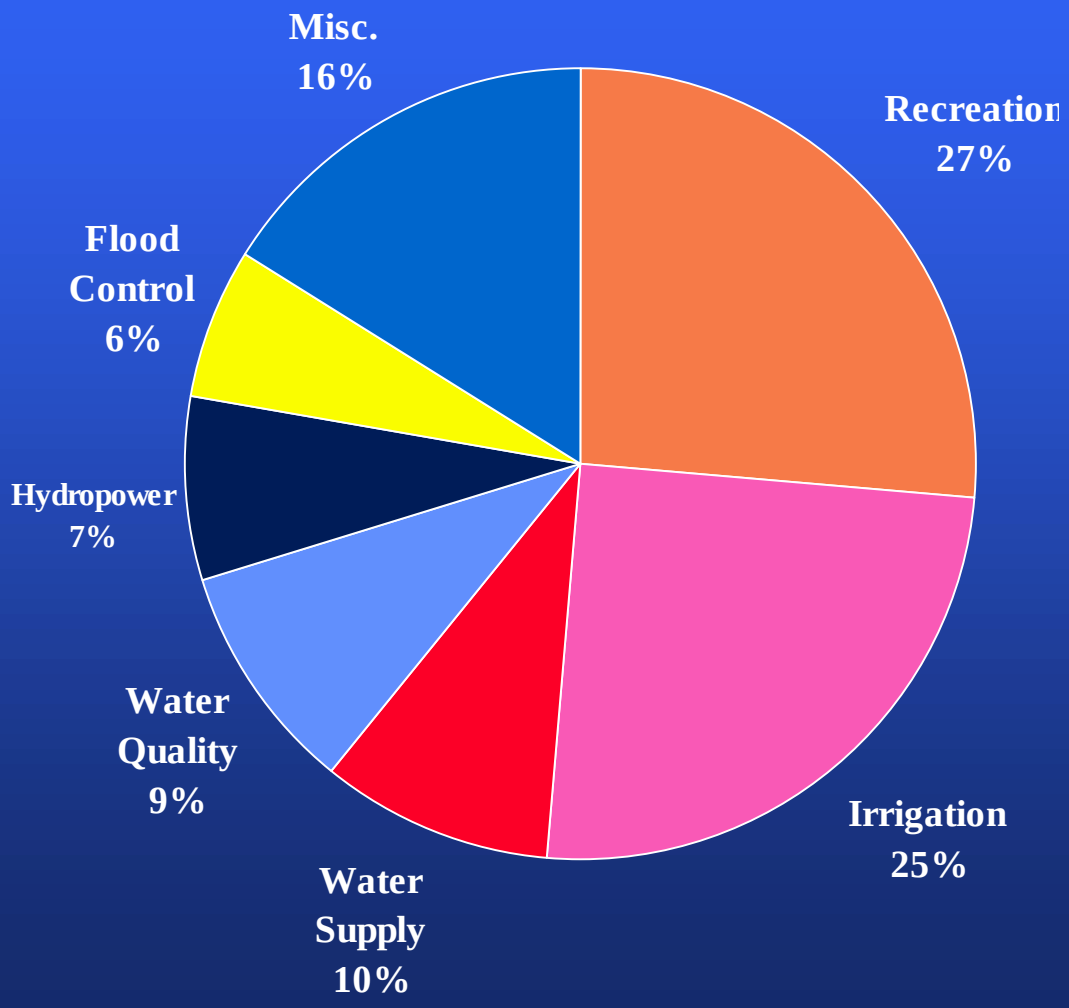
Dams in Washington

- Over 1025 dams in state which store > 10 acre-feet
- 69 Federally Owned
- 76 Hydropower Regulated by FERC
- 880 Dams Regulated by Ecology
- Only 94 dams are > 50 feet high



Two Classes of Dams

On Channel: Sited on a main-stem river or stream, filled directly by flow from upstream watershed.

Off Channel: Sited outside the main river valley, on minor tributary or completely off stream. Small natural drainage basin above dam. Water to fill reservoir is primarily diverted by gravity or pumping from larger adjacent basin.

Benefits & Drawbacks

On-Channel Dams

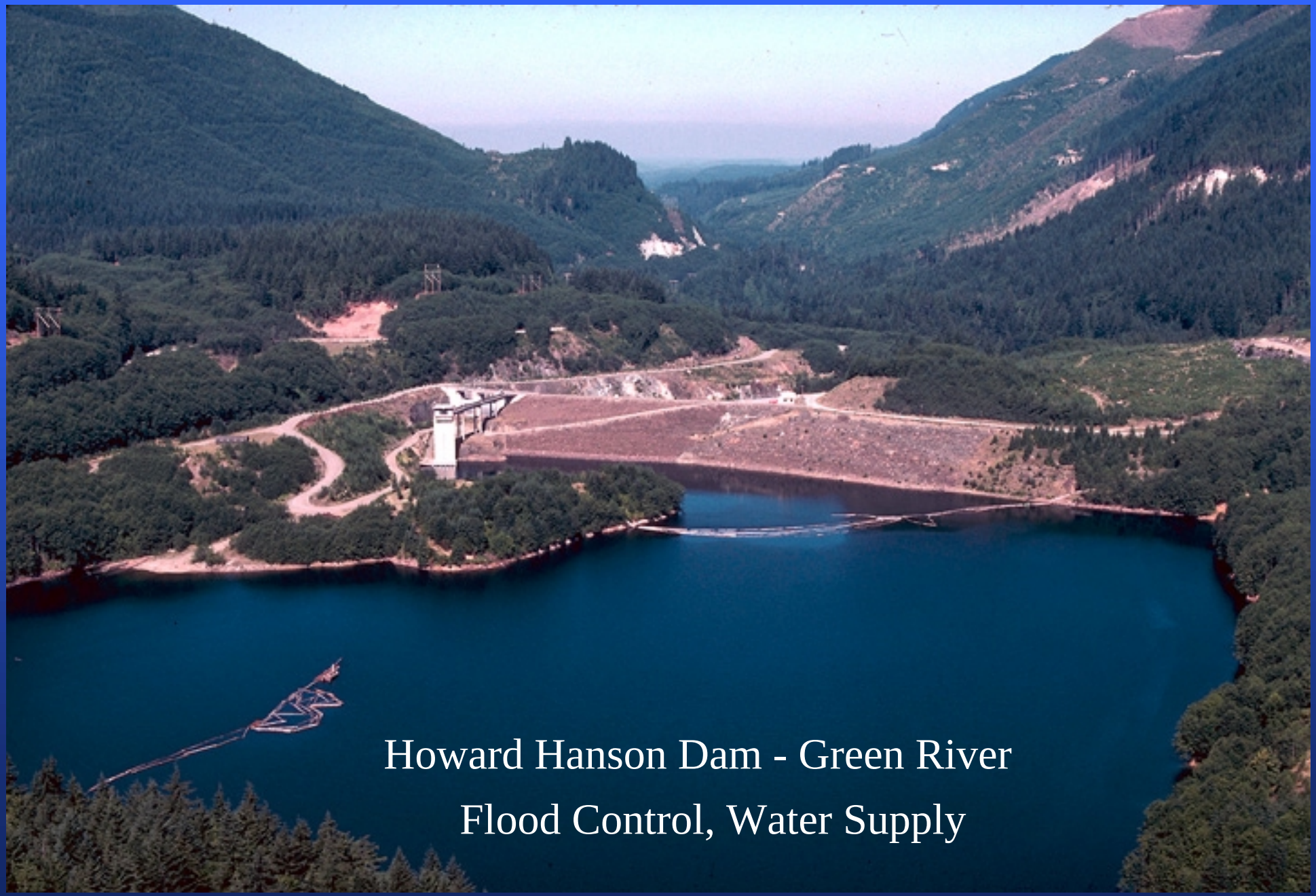
Benefits

- Existing Conveyance System (river) can carry all runoff from basin.
- Can store large quantity of annual runoff.
- Can provide substantial flood control benefit
- Usually less expensive construction and O & M costs than for large off-channel projects.

Drawbacks

- Barrier to fish passage
- Drowns riparian habitat.
- Sediment load can fill in reservoir
- Requires relocation of people, infrastructure
- Conservation groups likely to oppose on principle - removes free-flowing river
- Requires large spillways and outlet works


Grand Coulee Dam - Columbia River



Howard Hanson Dam - Green River

Flood Control, Water Supply

Mud Mountain Dam - White River

Flood Control

Benefits & Drawbacks

Off-Channel Dams

Benefits

- Generally do not represent a barrier to fish passage
- Can be sited in a non-environmentally sensitive area
- Reduced adverse water quality effects on main river
- Much smaller spillways and outlet works needed

Drawbacks

- Require extensive conveyance infrastructure to get water into and out of reservoir
- Diversions from main river into reservoir can still adversely affect streamflow + fish & wildlife habitat
- The $/af construction costs and O&M can be much higher
- Reservoir leakage and seepage a bigger problem - May need to be lined


Salmon Lake Dam, Conconully

Lake Chaplain Dam - City of Everett

Patterson Lake Dam - Wolf Creek


French Canyon Dam - Tieton

Dry Falls Dam - Banks Lake

Another Option - Raise Existing Dams

Benefits

- Dam is already in place, free flowing river already gone
- Environmental impacts are relatively smaller compared to a new dam
- Fish and wildlife in stream already subjected to regulated flow regime.
- Incremental cost of adding storage typically much lower than for new dam projects

Illustrative Example of Storage Potential of Existing Dams

- Currently 165 water supply and/or irrigation reservoirs in WA with > 50 acre-feet storage capacity
- Combined storage of these dams is 16.25 million acre-feet at the spillway crest elevation.
- Available storage if reservoirs were filled to the dam crest level = 17.56 million acre-feet
- Potential additional storage below dam crest level = 1.31 million acre-feet.

Another Option - Raise Existing Dams

Drawbacks

- May not be able to obtain new water rights
- Property acquisition and infrastructure relocation costs for higher reservoir level.
- Environmental impacts will require mitigation
- Opens the door for new requirements from regulatory agencies, e.g. new fish ladders

Example Costs for New Dams

Project Name	On/Off Channel	Total Cost	Dam Height	Storage	Cost/AF	Purpose/Use
Pine Hollow Reservoir	Off (Proposed)	$50.5 million	185 ft.	24,000 acre-feet	$2145	Irrigation, Fish
Wenatchee Heights #2	Off	$241,600	30 ft	80 acre-feet	$3020	Irrigation
Ritschard Reservoir (Colorado)	On	$32 million	122 ft.	66,000 acre-feet	$485	Irrigation, Municipal
Westminister Lake (Colorado)	Off	$3.7 million	31 feet	955 acre-feet	$3860	Municipal
Eastside Reservoir (California)	Off	$2.1 billion	280 feet	800,000 acre-feet	$2625	Municipal, Irrigation

Example Costs for Raises of Existing Dams

Project Name	On/Off Channel	Total Cost	Dam Raise	Storage Increase	Cost/AF Increase	Purpose/Use
Patterson Lake Dam	Off	$100,000	3 feet	500 acre-feet	$200	Irrigation,
Keechelus Dam (Cost to rebuild dam and retain storage instead of permanent drawdown)	On	$31.9 million	N/A	110,000 acre-feet	$290	Irrigation
Cle Elum Dam (Proposed)	On	$16.7 million	3 feet	14,600 acre-feet	$1140	In-Stream Flow
Wenas Dam (1982)	On	$3.5 million (Yr. 2000 dollars)	35 ft	2200 acre-feet	$1590	Irrigation
Judy Reservoir (Under Const)	Off	$9 million	10 ft.	1,700 acre-feet	$5294	Municipal

Summary

- Raising existing dams may be cheapest and most environmentally acceptable way of increasing reservoir storage.
- If new new storage dams are needed, off-channel projects are the more environmentally sensitive alternative. However, they can be expensive to build and operate.
- Realistically, the chances of building any new large dams on major rivers are practically nil.

Summary (cont.)

- Other options may be more cost effective than increasing reservoir storage, such as water conservation programs, reducing leakage, reuse of wastewater, reallocating existing reservoir storage etc.